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SECTION III.—FORECASTS.

FORECASTS AND WARNINGS FOR NOVEMBER, 1917.

By H. C. FRANKENFIELD, Supervising Forecaster.

[Dated: Weather Bureau, Washington, D. C., Dec. 8, 1917.]

GENERAL PRESSURE DISTRIBUTION OVER THE NORTHERN HEMISPHERE, EXCEPT EUROPE AND INTERIOR ASIA.

Over the North Pacific Ocean, as indicated by the reports from Midway and Honolulu, pressure was generally high during the first two weeks of November, 1917, with a marked crest over the central portion from the 6th to the 8th, inclusive. After the 14th there were alternate periods of moderately low and high pressure, with a fair depression from the 16th to the 18th, inclusive.

Over the Aleutian Islands, as indicated by the reports from Dutch Harbor, pressure was generally high throughout the month, with a pronounced maximum on the 29th. There was also another fairly marked crest on the 11th.

Over Alaska pressure was generally low during the first half of the month, with the exception of a short period of high pressure over the interior districts on the 10th. During the second half of the month there were successive periods of well defined high and low pressure areas, each of about 3 days' duration, with very low pressure over southeastern Alaska on the 28th and equally marked high pressure over the interior on the 30th, the latter the eastward extension of the Aleutian high area above mentioned.

Over the western portion of the United States moderately high pressure prevailed generally during the first three weeks of the month, after which pressure was low for three days followed by a recovery to above normal conditions during the next 4 or 5 days, with another fall during the closing days of the month. The first of these low areas apparently originated over the section east of Alaska and moved southeastward with rapidly increasing intensity and by the 22d, when it had reached the upper Lakes Region, it had developed into a storm of great intensity attended by strong gales and snow. After leaving the upper Lakes the storm continued to move southeastward with rapidly decreasing intensity, although the general depression extended in marked form as far south as northern Florida. Aside from this great general depression barometric conditions were not unusual over the eastern half of the country, moderately high pressure prevailing during the first decade of the month and nearly normal conditions during the remaining days until the 25th, when a rise set in that continued for about three days.

Over the North Atlantic Ocean low pressure predominated, with a pronounced depression that moved northward, rapidly increasing in intensity and passing off the New England coast on the 10th with the proportions of a severe storm.

STORM WARNINGS.

During the first week of the month low pressure prevailed over the Caribbean Sea, and on the morning of the 4th a high-pressure area of great magnitude covered the United States and Canada with a crest of 30.7 inches over Ontario. The resulting gradient indicated the occurrence

of fresh to strong north and northeast winds along the Atlantic coast, and small-craft warnings were accordingly ordered from Norfolk, Va., to Nantucket, Mass. Moderately strong winds occurred.

On the morning of the 18th, with rapidly rising pressure following a moderate disturbance, small-craft warnings for moderately strong northwest winds were ordered at all Lake stations: and the winds occurred as forecast. At 8 p. m. of the 18th with the disturbance over New Brunswick, warnings of strong northwest winds with much cooler weather were ordered at New York City and Sandy Hook, N. J. Moderate gales occurred both in this vicinity and locally along the New England coast.

On the morning of the 19th a disturbance from the Canadian Northwest was central north of Manitoba with an eastward movement, and at 2:30 p. m. advisory warnings of fresh to moderately strong southwest and west winds were sent to stations on Lake Superior and northern Lakes Michigan and Huron. This disturbance did not develop further, and no winds of consequence occurred. On the following morning there was a very moderate disturbance over Louisiana with a northeastward movement, and at 2:15 p. m. advisory warnings were issued for moderately strong northeast and north winds on the North Carolina and Virginia coasts. There were fresh winds on the North Carolina, but none on the Virginia coast.

On the morning of the 21st another Canadian Northwest disturbance was central over western Lake Superior, and northwest warnings were ordered at 10 a. m. for western Lake Superior, and southwest warnings for eastern Lake Superior, northern and central Lake Michigan and northern Lake Huron. This storm continued to move slowly southeastward with steadily increasing intensity, and at 4:30 p. m. northwest storm warnings were ordered for the balance of Lake Michigan, and southwest warnings on southern Lake Huron and Lakes Erie and Ontario. This storm proved to be the most severe one of the month, and on the evening of the 21st it was central over southern Michigan, with a barometer reading of 29.16 inches. On the following morning the storm center was over the northwestern shore of Lake Erie and fresh to strong gales were blowing over Lakes Superior, Michigan, and Huron. At Middle Island, Mich., the wind velocity was 66 miles an hour from the northeast, with heavy snow falling. Warnings that were about to expire were continued, and at noon whole gale warnings were ordered from Alpena, Mich., to Erie, Pa., and advices issued that it was dangerous for vessels to proceed on Lakes Huron and Erie. At 3:30 p. m. the warnings on eastern Lake Erie and Lake Ontario were changed to northwest. The gales occurred as forecast, except on Lake Ontario and eastern Lake Erie, which were not greatly affected, as the storm, after crossing Lake Erie, continued east-southeastward with rapidly decreasing intensity, a secondary disturbance having developed during the afternoon of the 22d over northern New Jersey. Notwithstanding the severity of the storm on the Upper Lakes, no marine casualties were reported.

While the above storm was moving southeastward, the moderate southern disturbance was moving northeastward and was just off the North Carolina coast on the

morning of the 21st. There was some prospect of increasing development with the northeastward movement, and advisory warnings to this effect were sent at 3 p. m. to North Atlantic and southern New England coast stations. The disturbance deepened as expected, and owing to the approach of the Lakes storm orders were issued at 9:30 p. m. to display southwest storm warnings at 8 a. m. of the 22d from Delaware Breakwater, Del., to Portland, Me. The winds were expected to increase from south and southwest and to shift to northwest by the 23d, reaching gale force. During the 22d pressure continued to fall rapidly throughout the East and South, reaching 29.48 inches at Savannah, Ga., at 1 p. m.; accordingly at 4 p. m. northwest storm warnings were ordered from Reedy Island, Del., to Jacksonville. Orders were also issued to change the warnings to northwest at 8 a. m. of the 23d from Delaware Breakwater to Portland, and to hoist northwest warnings east of Portland. However, by the morning of the 23d the storm had greatly decreased in intensity and all warnings were lowered.

No other storm warnings were issued during the month, except for the Canal Zone. On the morning of the 3d marked high pressure prevailed over the South and low pressure over the Caribbean, and warnings for strong northerly winds during the next two days were sent to the Canal Zone. This warning was justified by the occurrence of strong northerly winds that reached a maximum of 40 miles an hour from the northwest at 5:30 a. m. of the 5th. Mr. R. Z. Kirkpatrick, Chief Hydrographer of the Panama Canal, reported as follows regarding this storm:

A high wind accompanied by occasional showers prevailed over the Atlantic side during the day and night of the 4th and the morning of the 5th. The wind averaged 23 miles per hour for the 23-hour period from 9:30 a. m. of the 4th to 8:30 a. m. of the 5th. The storm started with the wind in the southwest, gradually shifting to the northwest by 4:30 a. m. of the 5th and obtaining a maximum velocity of 40 miles from the northwest at 5:30 a. m. of the 5th. At 8:30 a. m. of the 5th the wind velocity had dropped to 20 miles an hour from the northwest. The sea and the bay were rather rough and a heavy swell was in evidence outside the breakwater, but no damage has been reported. During the period of the storm the temperature fluctuated between 80° and 73°.

The following table will give a general idea of the rainfall over the Isthmus during the period of the storm.

Canal Zone rainfall during storm of Nov. 4-5, 1917.

Stations.	Rainfall.		
	Amounts.	Began.	Ended.
	<i>Inches.</i>		
Colon.....	2.73	Noon, 4th.....	4 a. m., 5th.
Gatun.....	2.30	Noon, 4th.....	6 a. m., 5th.
Monte Lirio.....	2.85		
Frijoles.....	1.46		
Vieja.....	2.21	8:45 a. m., 4th.....	4 a. m., 5th.
Alhajuela.....	2.15	9 a. m., 4th.....	4 a. m., 5th.
Juan Mina.....	2.67		
Gamboa.....	1.64	9:15 a. m., 4th.....	11 a. m., 5th.
Empire.....	0.99		
Culebra.....	1.06		
Rio Grande.....	0.88		
Pedro Miguel.....	0.72	12:30 a. m., 5th.....	11 a. m., 5th.
Balboa Heights.....	0.58		

No damage was done to Canal structures. However, the schooner *Blanche E. Pendleton*, which was swept ashore in the outer harbor of Colon during the night of February 8-9, 1915, and has lain there since, broke up during the night of November 5. Also an 18-foot cayuca, carrying 12 persons, was upset in Gatun Lake and 6 persons drowned. The wind started at Colon from the west, later veering to the northwest. The waves overtopped the West Breakwater for spaces of 600 feet at times.

On the morning of the 24th there was a more moderate high area central over Arkansas and Louisiana with strong northwest winds over northwestern Cuba and the Yucatan Channel, and warnings of strong north winds were again sent to the Canal Zone. These occurred as forecast, but they set in earlier than had been anticipated, although the maximum wind of 42 miles an hour from the northwest did not occur until 7:28 p. m. of the 25th. Mr. Kirkpatrick has written as follows regarding this storm:

The stormy period from November 15 to 25, inclusive, reached its climax on the 24th and 25th in an unusually high wind of the "norther" type. During the fore part of this period the winds were moderate and mostly from the west and southwest. By the 22d the wind had shifted to northwest and continued to blow from that direction with occasional changes to north. By 3 a. m. of the 24th it had increased in velocity to 25 miles per hour and continued to average from 25 to 34 miles per hour till 8 a. m. of the 25th, when it moderated and by afternoon had fallen below 20 miles per hour. For the 17-hour period from 1 p. m. the 24th to 6 a. m. the 25th the wind averaged slightly over 31 miles per hour with a maximum velocity for a period of 5 minutes of 42 miles from the northwest at 7:28 p. m. This has been exceeded only once in the last 10 years.

The storm was accompanied by light showers. The barometer averaged 0.08 inch above normal and the reading at 8 a. m. the 24th, 29.975 inches, is with one exception the highest ever recorded in November. The temperature was subject to sudden changes [and ranged] from 79° to 72°. A heavy swell was running outside the harbor and the water in the bay was very rough and choppy.

No material damage was reported.

On the morning of November 26, although high pressure conditions over the eastern half of the United States and the Gulf of Mexico were more strongly marked than on the 24th, a warning of strong north and northeast winds for the Canal Zone apparently failed of full local verification, but nevertheless strong northeast winds were reported a few hundred miles to the east-northeastward on the morning of the 28th.

Under date of December 1, 1917, Mr. Kirkpatrick wrote as follows regarding this warning:

During this period the wind blew continually from the north and northeast, the hourly amounts varying from 2 to 23 miles. The wind was light to moderate during the night, reaching its greatest velocity in the middle of the day. On the 27th it averaged 17 miles from 11 a. m. to 5 p. m., and on the 28 the sea was reported unusually rough at the entrance to the harbor.

There were 1.54 inches of rain on the 27th and 0.23 inch on the 28th.

FROST WARNINGS.

November opened with low temperatures prevailing throughout the South, and frost warnings were issued on the 1st, 2d, 3d, and 6th. Those of the 3d included northern Florida, where the minimum temperatures on the following morning ranged from 38° to 44° with clear weather. As the cold weather continued, no further warnings were sent for the local frosts that occurred during the ensuing 7 days north of Florida.

On the morning of the 12th, with a moderate disturbance over Alabama and high pressure closely following, frosts were forecast for the morning of the 13th over northern Alabama and interior Mississippi; but the weather remained cloudy. On the morning of the 15th pressure was again high over the Gulf States and the Central Valleys, and frosts were forecast for the morning of the 16th throughout the South as far as northern Florida. The warnings were repeated on the following morning and frosts appear to have occurred quite generally as had been forecast.

On the morning of the 23d, following the Lakes storm, frost warnings were sent to the Carolinas and Georgia;

but subsequent events showed that they should have been sent generally throughout the South, as heavy frost was reported on the morning of the 24th over northern Florida and temperatures below freezing in the eastern Gulf States.

General frost or freezing-temperature warnings for the South were sent out on the 24th and 25th, the frost being expected to extend into central Florida on the morning of the 25th and as far south as the 26th parallel on the morning of the 26th. These warnings were fully verified, light frost occurring in Florida on the morning of the 25th to a short distance below the 26th parallel.

"NORTHERS" OF THE CANAL ZONE.

The constantly increasing magnitude and importance of traffic through the Panama Canal has lent an additional interest and value to the meteorological conditions of that vicinity, and among the most important of these are the strong northwest to northeast winds that blow at times from November to April. These continue from one to as many as eight days, and frequently cause considerable damage to shipping, dock structures, etc. These "northers" are not by any means confined to the locality of Panama, but cover the western Caribbean, western Cuba, the Gulf of Mexico, the eastern coast of Mexico, and the coasts of the Central American Republics. The literature on the subject is quite extensive, the earliest contribution probably having been that of Redfield, in the *American Journal of Science* for 1844 (second series, vol. 1). In his discussion of the question Redfield treated principally the "northers" that occurred on the Mexican coast following the passage of West Indian hurricanes. They occur more often, however, without than with the passage of hurricanes, although the general pressure distribution over large areas is mainly of the same character. The most recent contribution on the subject is an unpublished manuscript by Mr. George J. Bentley, observer, Weather Bureau, who was formerly connected with the Hydrographic and Meteorological section of the Panama Canal. In his paper Mr. Bentley makes a proper differentiation between "northers" and "trade winds," the former being fresh to strong gusty and squally, from northwest to northeast and accompanied by intermittent rainfall, while the latter are more moderate, steady, and very constant winds from the northeast and seldom accompanied by rainfall. Quite recently Mr. R. Z. Kirkpatrick, chief hydrographer of the Canal Zone, submitted a memorandum on these "northers." This memorandum contained much valuable information of a historical character and it is therefore reproduced virtually in its entirety.

Historical notes on northers.—The following memorandum on "northers" was prepared from all data both French and American which were available. Information on "northers" prior to American occupation is taken for the most part from a report of Mr. Duboc to the director of French works in July, 1881.

The only storms of wide extent that visit the Isthmus are the so-called "northers" that occasionally reach as far south as Colon during the period from November to April, the season of the northerly trade winds. They

are occasioned by an anticyclonic or high-pressure area over the Gulf and West Indies, there being a strong steady blow from this region of high barometric pressure toward the equatorial belt of low pressure. The principal damage to shipping interests results from the heavy swell and high waves that accompany these "northers" and not from any extremely high maximum wind velocities. The barometer does not indicate their approach and they come suddenly, attaining their full violence shortly after their appearance. There is, however, ordinarily a considerable rise in pressure accompanying or following the passage of these storms.

The following table gives a list of "northers," the date of occurrence, direction of the wind, together with remarks as to the damage done by the storms.

List of "northers" from French records for the Canal Zone.

Year.	Month.	Direction of wind.	Vessels wrecked.	Remarks.
1857..	November...	nnw.....	7	Much damage to wharves.
1861..	Oct. 32.....	n.....	3	
1865..	October.....	sw.....	5	Lasted 6 hours; damage, \$300,000.
1872..	February....	nnw.....	5	Wharves damaged.
1873..	Jan. 18-19....	nnw.....	6	Sea furious. Wharves 5 and 6 partly destroyed; 2 vessels damaged at wharves.
1878..	Dec. 8.....	nnw.....	4	Royal Mail steamer <i>Para</i> resisted with 2 anchors and 93 fathoms of chain, under strong steam.
1879..	Nov. 21-24...	n.....	4	Wharves 4 and 6 damaged.

The following is an extract from the report of Mr. Duboc:

The sailors of Colon are of one accord in affirming that a "norther" may occur every year. However, they are not generally to be expected more than once in two years. The "northers" of 1878 and 1879 were both very strong, while, on the contrary, that of 1880 was nearly imperceptible (February), but in November or December, 1881, there was a veritable tempest.

The above are all the available data of the "northers" of 1880 and 1881.

The following table gives other "northers" of which we have knowledge, together with dates and remarks:

Year.	Month.	Remarks.
1885	Dec. 2-5.....	14 vessels said to have been stranded.
1905	Jan. 26-27.....	No damage reported.
1905	December.....	5 days' duration, last week in December.

The record of "northers" between 1881 and 1906 is very meager, and it is hardly likely that those listed above were all that occurred.

In the table following are listed those storms in which the wind averaged 18 or more miles an hour for a period of at least 24 hours, with a maximum velocity exceeding 25 miles an hour. This data is taken from Cristobal and Colon records from December, 1907, to October, 1917. The storms listed below can not all be considered as "northers" in the true sense of the word, although they are all a direct result of the interchange of air which takes place between an area of high barometric pressure over the Gulf and West Indies and the equatorial belt of low atmospheric pressure.

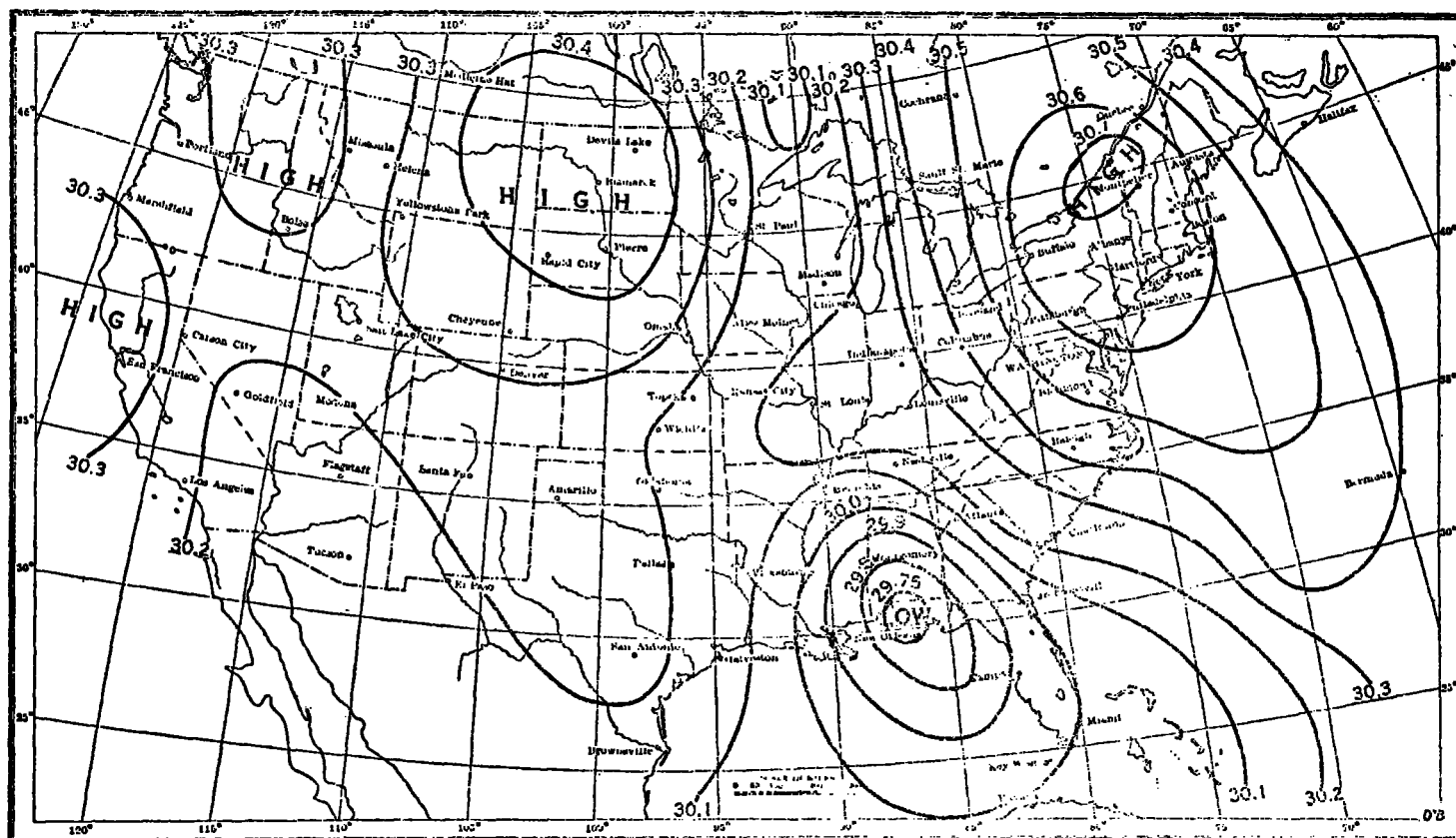


FIG. 1.—Pressure distribution on Feb. 11, 1910, preceding the norther of Feb. 13-15, 1910, in the Canal Zone. At Colon the wind attained a velocity of 36 mis./hr. from northwest.

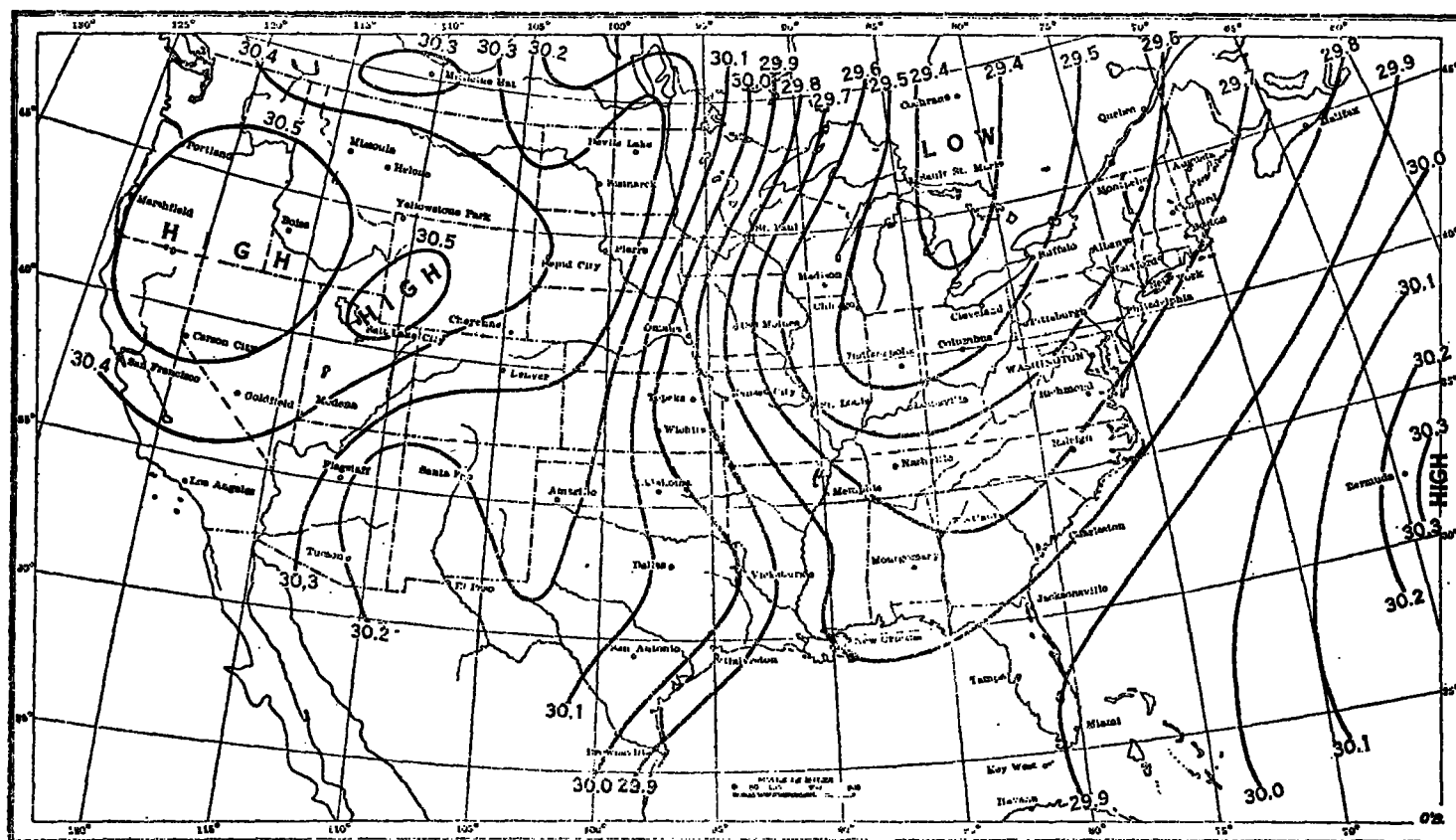


FIG. 2.—Pressure distribution on Mar. 15, 1913, preceding the norther of Mar. 17-19, 1913, in the Canal Zone. At Colon the wind attained a velocity of 36 mis./hr. from northeast.

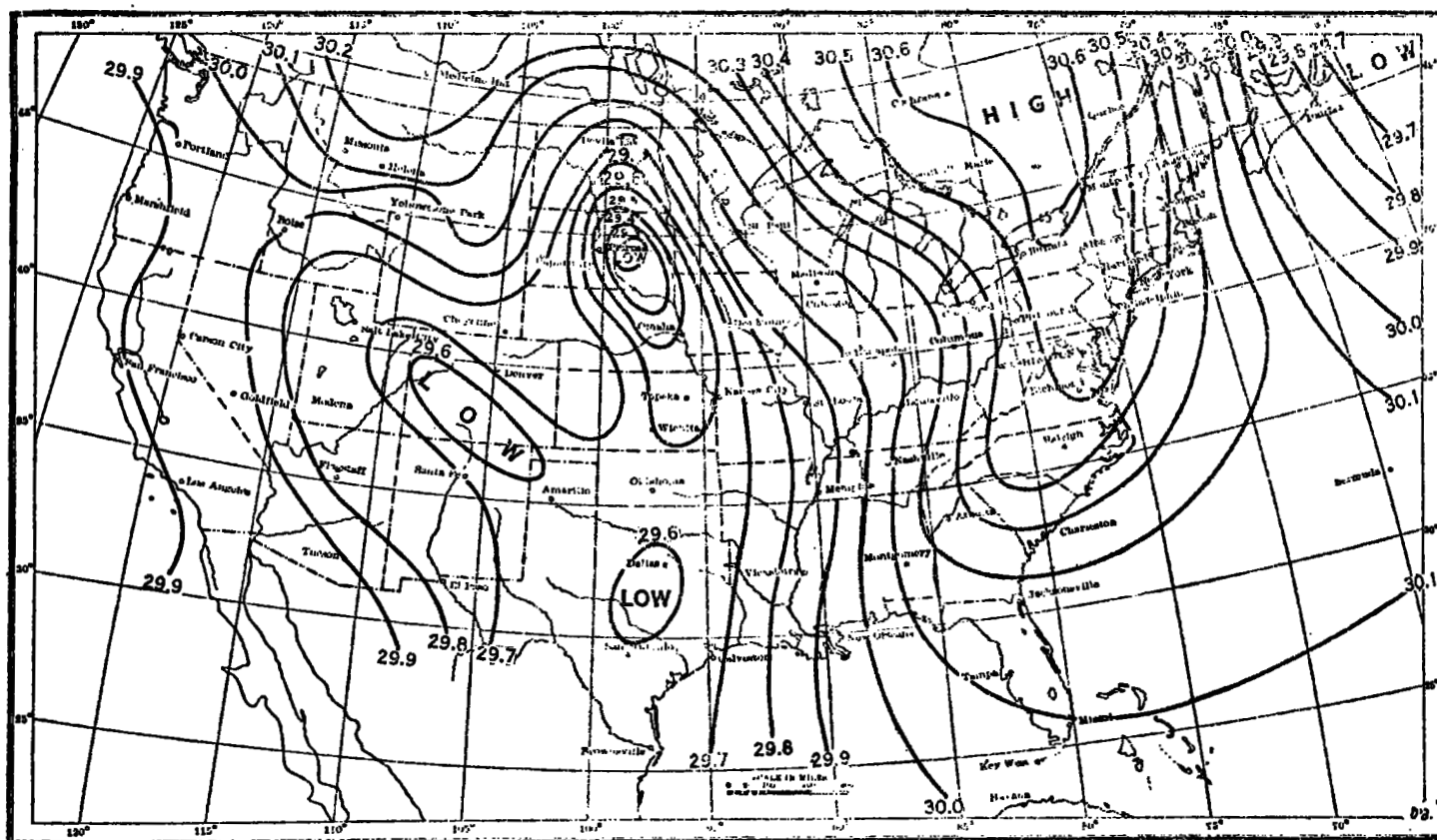


FIG. 3.—Pressure distribution on Dec. 26, 1916, preceding the norther of Dec. 28, 1916-Jan. 3, 1917, in the Canal Zone. At Colon the wind attained a velocity of 33 mis./hr. from northwest.

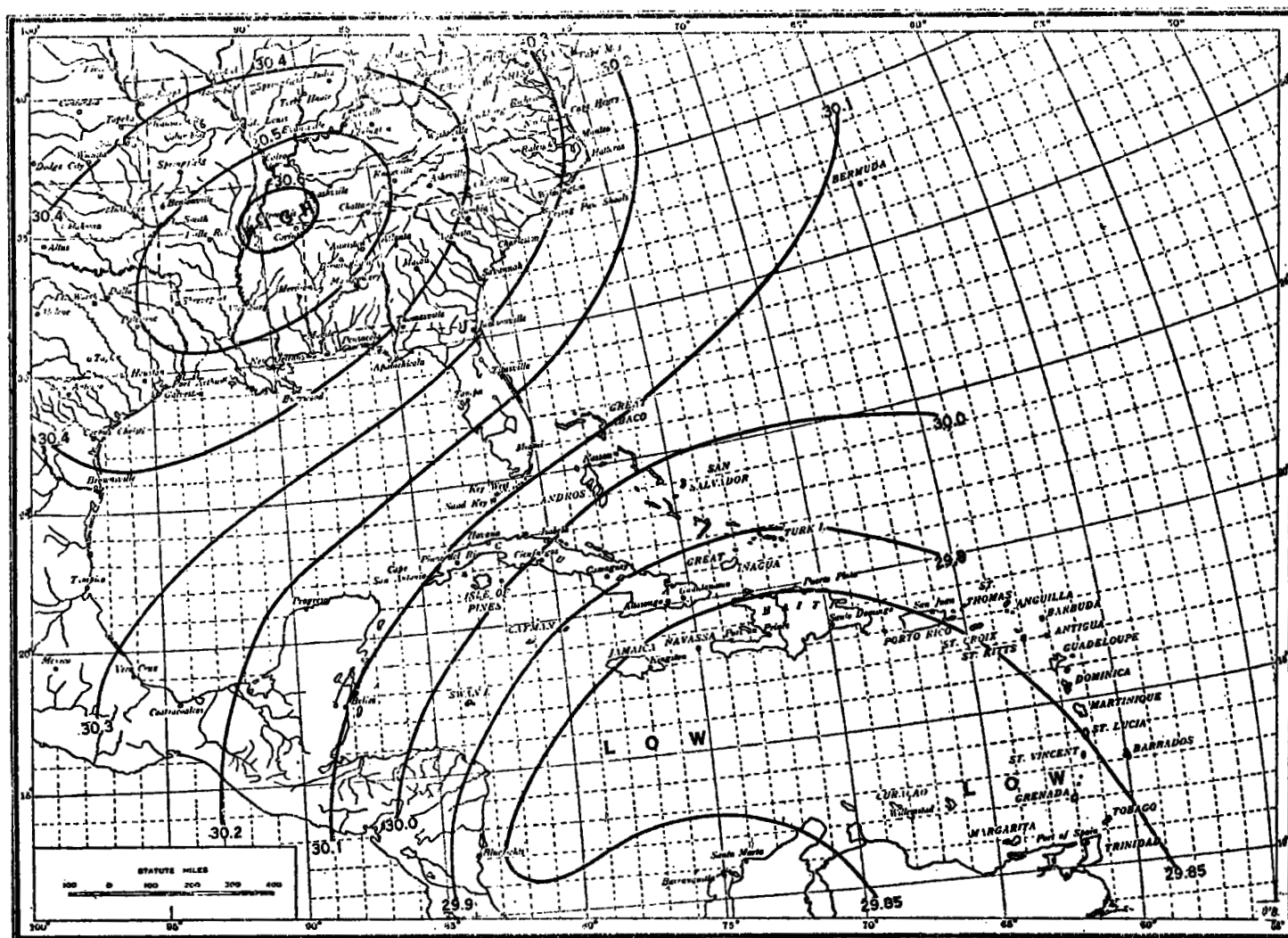


FIG. 4.—Pressure distribution on Nov. 3, 1917, preceding the norther of Nov. 4-5, 1917, in the Canal Zone. At Colon the wind attained a velocity of 40 mis./hr. from northwest.

Dates (inclusive).	Maximum wind velocity.		Dates (inclusive).	Maximum wind velocity.	
	Miles per hour.	Direction.		Miles per hour.	Direction.
Dec. 25-28, 1907.....	28	ne.	Feb. 9-14, 1915.....	39	n.
Dec. 31, 1907-Jan. 3, 1908	27	ne.	Feb. 18-19, 1915.....	34	n.
Jan. 14-15, 1908.....	31	ne.	Feb. 24-27, 1915.....	23	ne.
Feb. 2-4, 1908.....	28	ne.	Mar. 2-3, 1915.....	30	ne.
Feb. 20-22, 1908.....	31	ne.	Mar. 12-13, 1915.....	30	ne.
Mar. 6-12, 1908.....	23	ne.	Mar. 24-26, 1915.....	32	ne.
Apr. 4-10, 1908.....	32	ne.	Apr. 3-6, 1915.....	46	n.
Jan. 8-9, 1909.....	31	n.	Dec. 13-14, 1915.....	30	ne.
Jan. 31-Feb. 1, 1909.....	32	n.	Dec. 31, 1915-Jan. 1, 1916..	31	ne.
Feb. 17-18, 1909.....	28	n.	Jan. 4-5, 1916.....	31	n.
Jan. 16-19, 1910.....	27	n.	Jan. 19-31, 1916.....	31	n.
Jan. 30-31, 1910.....	31	n.	Jan. 21-25, 1916.....	33	n.
Feb. 13-15, 1910.....	36	nw.	Feb. 3-5, 1916.....	32	ne.
Dec. 3, 1910.....	38	n.	Feb. 8-10, 1916.....	30	ne.
Feb. 16-18, 1911.....	27	ne.	Feb. 20-21, 1916.....	27	n.
Feb. 21-24, 1911.....	30	n.	Feb. 26-28, 1916.....	27	n.
Mar. 6-7, 1911.....	26	ne.	Mar. 4-6, 1916.....	30	n.
Apr. 14-17, 1911.....	28	n.	Mar. 17-21, 1916.....	34	n.
Nov. 30-Dec. 2, 1911.....	34	ne.	Dec. 28, 1916-Jan. 3, 1917..	33	nw.
Dec. 28-31, 1911.....	34	ne.	Jan. 16-18, 1917.....	33	nw.
Jan. 5-6, 1912.....	32	ne.	Jan. 20-21, 1917.....	25	nw.
Jan. 21-25, 1912.....	27	n.	Jan. 27-Feb. 3, 1917.....	36	nw.
Feb. 27-Mar. 5, 1912.....	33	ne.	Feb. 6-7, 1917.....	28	nw.
Mar. 14-21, 1912.....	28	ne.	Feb. 11-12, 1917.....	26	nw.
Apr. 23-27, 1912.....	33	ne.	Feb. 19-25, 1917.....	39	nw.
Nov. 18-20, 1912.....	33	nw.	Mar. 2, 1917.....	27	ne.
Feb. 10-12, 1913.....	32	ne.	Mar. 6, 1917.....	27	ne.
Mar. 7-9, 1913.....	31	ne.	Mar. 8-16, 1917.....	29	ne.
Mar. 17-19, 1913.....	36	ne.	Mar. 18-22, 1917.....	32	ne.
Mar. 22-24, 1913.....	31	ne.	Nov. 4-5, 1917.....	40	nw.
Dec. 27-28, 1913.....	32	ne.	Nov. 24-25, 1917.....	42	nw.
Feb. 8-10, 1914.....	28	ne.			
Feb. 15-18, 1914.....	28	ne.			
Mar. 8-14, 1914.....	35	ne.			
Mar. 22-28, 1914.....	28	n.			
Apr. 22-23, 1914.....	29	n.			

—R. Z. Kirkpatrick, Chief Hydrographer, Canal Zone.

Study in detail of 26 of the more important of the northers disclosed that while all were ultimately due to strong high pressure to the northward with steep gradients, yet the preceding pressure distribution may be of at least four closely related types. One map of each type, for a day immediately preceding the occurrence of a norther, is here reproduced as figures 1-4. The first type (fig. 1), preceded the norther of February 13-15, 1910, when the wind at Colon, Canal Zone, reached a velocity of 36 miles an hour from the northwest. On the morning of February 11, 1910, pressure was low over the eastern Gulf States and the eastern Gulf of Mexico—center of 29.72 inches at Pensacola, Fla.—with general and marked high pressure over the remainder of the United States—30.72 inches over the upper St. Lawrence Valley, 30.48 inches over North Dakota. Gradients were steep north-eastward.

The second type (fig. 2) preceded the norther of March 17-19, 1913, when the wind at Colon reached a velocity of 36 miles an hour from the northeast. On the morning of March 15 pressure was low over the eastern half of the United States—29.32 inches at Alpena, Mich.—and high over the western half of the United States as well as over the Atlantic Ocean—30.54 inches over Wyoming and 30.30 inches over Bermuda, with steep gradients especially in the central West. The low pressure extended down to the Gulf coast giving 29.78 inches at Pensacola, Fla.

The third type (fig. 3) preceded the norther of December 28, 1916-January 3, 1917, when the wind at Colon reached a velocity of 33 miles an hour from the northwest. On the morning of December 26 marked low pressure covered the Plains States—29.30 inches over eastern South Dakota, 29.60 inches over southern Texas with

equally marked high pressure over the eastern half of the United States—30.66 inches at Cochrane, Ontario. Gradients were very steep everywhere except over Texas. The fourth type (fig. 4) preceded the norther of November 4-5, 1917, when the wind at Colon reached a velocity of 40 miles an hour from the northwest. On the morning of November 3, pressure was low (29.82 in.) over the entire Caribbean Sea, and high over the eastern United States—30.60 inches over western Tennessee.

The four types may be summarized as follows:

1. Low pressure over Gulf of Mexico, and high pressure to northward and northwestward.

2. Low pressure over eastern half of the United States extending down to the Gulf of Mexico, and high pressure over the western half of the United States with steep gradients, especially westward. This type is accentuated whenever high pressure prevails also over the middle Atlantic Ocean.

3. The reverse of No. 2.

4. Low pressure over the Caribbean Sea and high pressure over the eastern United States. Gradients not essentially as steep as in the preceding types, yet, nevertheless, well marked.

Following is a map showing the locations of the meteorological stations in the Canal Zone and a portion of Panama.

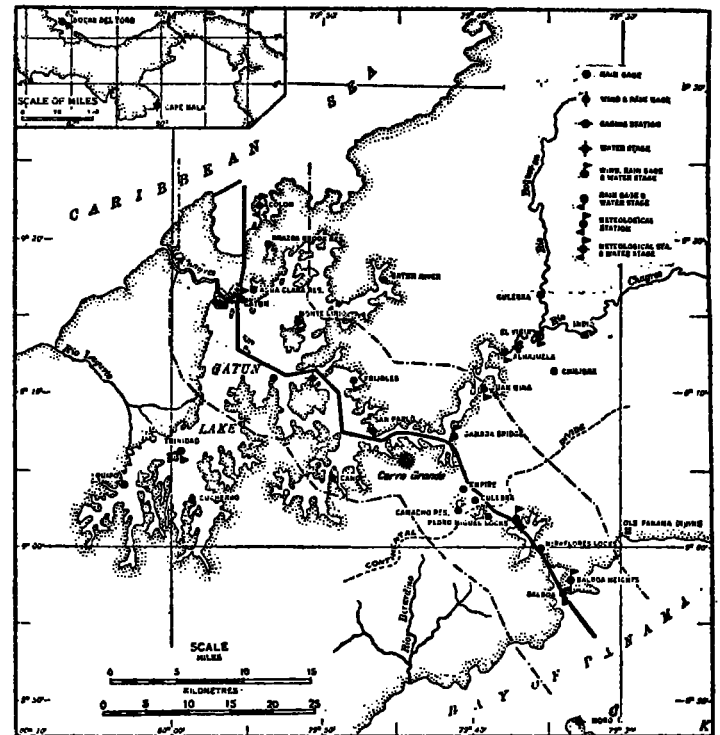


FIG. 5.—Location of meteorological stations in Canal Zone.

WARNINGS FROM OTHER DISTRICTS.

Chicago (Ill.) district.—No warnings were issued by this district during November, 1917.—*Chas. L. Mitchell, Assistant Forecaster.*

New Orleans (La.) district.—The weather was unusually free from disturbances. Although maximum wind velocities of 32 to 33 miles per hour slightly exceeding the verifying velocity of 30 miles, occurred at Galveston, Texas, on the 18th, 19th, and 22d, they were of too short duration to constitute storms, and the preceding conditions furnished no definite indication of their probability. No storm warnings were issued. In marked

contrast with the preceding month, no cold waves occurred and no cold-wave warnings were issued.

The anticyclonic conditions that continued over and to the eastward of this district during the first ten days resulted in cold nights, low wind movement, and the accumulation of much haze and smoke.

Frost warnings were issued as follows, and were justified:

Frost for southern Louisiana was forecast daily from the 1st to the 7th, inclusive; for the southern portion of eastern Texas, except in the lower Rio Grande Valley, on the 1st and 2d; and for the eastern half of the southeastern portion of eastern Texas on the 4th.

Frost was forecast on the 12th for the interior of Louisiana and of the southern portion of eastern Texas, except in the lower Rio Grande Valley; on the 15th and 16th, for Louisiana and extreme eastern Texas, with freezing in the interior of Louisiana in the forecast of the 15th; on the 20th, for Louisiana and eastern Texas, to the coast, with heavy frost in the interior; on the 22d, for the southern portion of Texas except on the immediate coast and in the lower Rio Grande Valley.

Temperatures lower than those anticipated from the preceding conditions occurred in Louisiana on the morning of the 24th, with freezing in the interior. Frost to the coast and freezing nearly to the coast in Louisiana, and frost in extreme eastern Texas, were predicted for the following morning and were verified.

Fire-weather warnings for the forested regions of Oklahoma and Arkansas were issued on the 17th. The wind occurred as forecast but the rain continued longer than was expected.

For the benefit of persons engaged in outdoor work, forecasts of fair weather for the entire district were extended 24 hours beyond the usual period on the 1st and 2d, and 48 hours on the 21st, and were verified.—

R. A. Dyke, Assistant Forecaster.

Denver (Colo.) district.—The month was free from severe storms. The only special warnings issued were for frost in south central Arizona on the 27th, 28th and 29th. These warnings were verified.—*F. H. Brandenburg, District Forecaster.*

San Francisco (Cal.) district.—Several times during the first half of November, 1917, storms approached the

northern edge of this district without causing very high winds at Weather Bureau stations, although at Triangle Island, British Columbia, about three hundred miles north of Tatoosh Island, Wash., winds varying from 60 to 76 miles were reported at the time the observation was taken. These storms moved eastward, but on account of their proximity storm warnings were issued on the 2d, 8th and 11th to our stations at the entrance to the Columbia River, Strait of Juan de Fuca, and the Gulf of Georgia. At the same time advisory messages were sent to Seattle, Tacoma, and the United States navy yard at Bremerton. While these warnings were only partly verified it is believed they were fully justified in view of the dangerous conditions prevailing but a short distance to the north. Storm warnings were also sent to northern seaports on the 26th, 27th and 29th. Verifying velocities occurred at Seattle during the night of the 27th, 28th and 29th–30th; but none was reported at the northern coast stations.

In addition storm warnings were ordered along the northern coast of California on the 29th and 30th; both were verified.

Small-craft warnings were issued on 8 occasions to two or more stations; it is believed that they served a useful purpose and were fully justified.

From the 14th to the 22d, and on the 26th and 27th, light frost formed at many places in the interior of California and also along its northern coast above Cape Mendocino. In some exposed locations the frosts were heavy, but they did no damage of consequence as the staple crops had previously been safely secured. Nearly all these frosts were predicted 24 hours in advance. Two frost warnings were issued which were not verified on account of the intervention of clouds that unexpectedly developed during the early morning.

During the middle portion of the month the weather was mostly of anticyclonic character and consequently the rain was light, especially in California and Nevada where more is badly needed for fall plowing and to start a new growth of grass for stock that had been brought from the mountains and placed on the winter ranges in the foothills and valleys.—*E. A. Beals, District Forecaster.*